



Perlites from East Mediterranean region: a comparative study of perlite quality characteristics and their utilization in the construction industry

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A comparative study of perlite deposits of the East Mediterranean Region is performed, in order to identify the factors that control their expansion capacity, and hence their suitability for certain industrial and environmental applications. Perlite deposits are methodically studied worldwide because of the unique characteristics each particular deposit has and the impact that perlite has to the global economy of industrial minerals. More than 100 perlite-based products exist in the Market. Perlite is a volcanic glass-rich rock, mainly used in its expanded state. It is characterized as a lightweight aggregate with significant thermal and acoustic insulation properties.

For the purposes of our study, perlite bulk samples originated from quarries in Milos Island, Greece, Sardinia Island, Italy, Kardjali region, Bulgaria, and Bergama region, Turkey were characterized and tested. The geological age of the deposits varies from Oligocene (Kardjali and Bergama) through Plio-Pleistocene (Milos).

From the locations above, fourteen representative bulk samples of 10kg each were studied:

- Mineralogically by light microscopy [LM], XRD and SEM analysis, and TG/DTA analysis.
- Chemically (major and trace elements analysis) by XRF and ICP-MS methods. In addition, moisture, Loss on Ignition [LOI], pH and soluble substances (Na, K, Cl) were measured.

The XRD analysis revealed that the main phase in all samples is the volcanic glass, distinguished by the broad hump at 19-26 degrees in the XRD pattern. However, some glasses contain embryonic opal-CT phase. Other mineral phases identified are feldspars, quartz and mafic minerals. LM studies revealed that the Kardjali perlite has de-vitrification texture, whereas Milos perlite is almost fresh.

Milos samples are richer in Si, Ca, Na, Li and poorer in Th, U, K, Rb and LOI than the other samples. Furthermore, Sardinia samples are richer in REE than the rest of the samples.

Tests on the expansion capacity of perlite grains 0.5-1.2mm in size, at certain temperatures, show that:

- the fine fractions that are not expandable are volumetrically higher in perlites from Kardjali.
- the samples from Milos and Bergama exhibit higher expansion capacity than the samples from Sardinia and Kardjali, the latter presenting the lowest expandability degree.
- there is no relationship between the age of the deposit and its expansion capacity. However, the youngest perlite of Milos exhibit the best expandability among all samples studied.
- the most reasonable parameter that might influence the expansion capacity of perlite is the variation in the disorder/order form of the volcanic glass content in the samples studied. As disordering predominates in Milos perlites, and ordering (de-vitrification) predominates in Kardjali perlites, it is plausible to suggest this relationship.

The crystalline phases of alkali feldspars hosted within the volcanic glass have respectively negative correlation with the expansion capacity. Quartz content is unconnected with expandability, as almost equal quartz content is noticed both to Milos and Kardjali samples. Other parameter that might influence the mechanism of forming highly expandable perlite is its eruption history. Notably, most of Milos high quality deposits are composed of reworked airborne pieces of perlite of various sizes, fallen sometime unsorted, into a shallow-marine environment.